**Remarks/Arguments**

Reconsideration of this Application is requested.

Claims 1 and 10 have been rejected by the Examiner under 35 USC §112 for failing to comply with the written description. The Examiner is of the opinion that there is no support in paragraph [0057] of Applicant's specification for the expression "average brightness levels for said data blocks" in step (e) of claims 1 and 10.

Applicant respectfully disagrees with the Examiners opinion. There is support in paragraph [0057] for the expression "average brightness levels for said data blocks" in step (e) of claims 1 and 10. The reason for the foregoing is that for each data block, there is only one brightness level, therefore, the average brightness level is the same as the brightness level because it has the same numeric value. The term "average" is included in claims 1 and 10 to clarify that the brightness level for each data block is an average of pixel gray scale values. When a correlation is performed in step (e) of claims 1 and 10, the detection of the watermark data is independent of the brightness level. The watermarked signal strength (recovered watermarked data) of Applicant's claimed invention is correlated with the brightness level.

Claims 1-2, 4, 9-13, 14-15 and 19 have been rejected by the Examiner under 35 USC §102(e) as being anticipated by Sharma et al. (US Publication No. 2004/0105569).

Sharma discloses the following in paragraph [0093]:

> "[0093] Next, the detector performs a correlation 610 between the transformed image block and the transformed orientation pattern 612. At a high level, the correlation process slides the orientation pattern over the transformed image (in a selected transform domain, such as a spatial frequency domain) and measures the correlation at an array of discrete positions. Each such position has a corresponding scale and rotation parameter associated with it. Ideally, there is a position that clearly has the highest correlation relative to all of the others. In practice, there may be several candidates with a promising measure of correlation. As explained further below, these candidates may be subjected to one or

more additional correlation stages to select the one that provides the best match."

Sharma is looking for correlation between a pattern and an image at the same frequency.

Sharma discloses the following in paragraph [0201]:

"[0201] There are a number of ways to calculate this figure of merit. One figure of merit is the degree of correlation between a known watermark signal attribute and a corresponding attribute in the signal suspected of having a watermark. Another figure of merit is the strength of the watermark signal (or one of its components) in the suspect signal. For example, a figure of merit may be based on a measure of the watermark message signal strength and/or origination pattern signal strength in the signal, or in a part of the signal from which the detector extracts the orientation parameters. The detector may computes a figure of merit based the strength of the watermark signal in a sample block. It may also compute a figure of merit based on the percentage agreement between the known bits of the message and the message bits extracted from the sample block."

Sharma discloses obtaining a signal level in a block, not how it relates to brightness in a block.

Sharma discloses the following in paragraphs [0186], [0188] and [0190]:

'[0186] 4.3 Estimating Translation Parameters

[0188 In this stage, the detector estimates translation parameters. These parameters indicate the starting point of a watermarked block in the spatial domain. The translation parameters, along with rotation, scale and differential scale, form a complete 6D orientation vector. The 6D vector enables the reader to extract luminance sample data in approximately the same orientation as in the original water-marked image.

[0190] To extract translation parameters, the detector proceeds as follows. In the multi-frame case, the detector selects the frame that produced 4D orientation vectors with the highest detection values (1080). It then processes the blocks 1082 in that frame in the order of their detection value. For each block (1084), it applies the 4D vector to the luminance data to generate rectified block data (1086). The detector then performs dual axis filtering (1088) and the window function (1090) on the data. Next, it performs an FFT (1092) on the image data to

> generate an array of Fourier data. To make correlation operations more efficient, the detector buffers the Fourier values at the orientation points (1094)."

The function described in Sharma paragraph [0188] describes Sharma's paragraph [0186] Estimating Translation Parameters. The purpose in Sharma paragraph [0188] is to estimate the rotation, scale, and differential scale of the 6D orientation vector. This estimate depends on the variation of the pixel gray scale values, but not on the (average pixel gray scale value) average brightness level. The average value will provide no information with regards to translation, scale and orientation. IN Applicant's claimed invention the strength of the varying watermark signal is dependent on the average pixel gray scale value in copies.

In paragraph [0190] Sharma discloses finding the orientation vector that maximizes the detection values. Applicant claims analyzing the strength of the watermark signal as a function of the wave vector of the watermark signal. This dependence will change upon copying.

The following will provide a simplified one dimensional illustration of the concepts in Sharma and in the claims of this application. The "Orientation Vector" in one dimension is just the phase (position) and wavelength rather than the four or six dimensional vector used in Sharma. The one dimensional example is sufficient to illustrate the point.

First set up indices for the pictures:

$r := 0..100 \qquad c := 0..50$

Next, as an example, we create a simple image with two data blocks that are uniform

$\text{Light} := 225 \qquad \text{Dark} := 100 \qquad \text{Orig}_{r,c} := \text{Dark} + (\text{Light} - \text{Dark})\cdot\Phi(r - 50.1)$

Now we add a watermark to the image. For simplicity we illustrate with a simple sinusoidal watermark.

$\text{WM}_{r,c} := \text{Orig}_{r,c} + 10\cdot\cos(c)$

In the signal in Sharma the geometry is distorted. Here we illustrate an example where the phase is shifted and the length scaled. In the general case in Sharma there is a four or six dimenaional orientation vector.

$\text{Media}_{r,c} := 100 + 125\cdot\Phi(r - 50.1) + (7 + 3\cdot\Phi(50.1 - r))\cdot\cos(c\cdot 1.1 + 2.3)$

If someone tries to copy a printed image the watermark strength will change differently in data blocks that are lower brightness than in data blocks that are higher brightness.

$\text{Copy}_{r,c} := 100 + 125\cdot\Phi(r - 50.1) + (5 + 5\cdot\Phi(50.1 - r))\cdot\cos(c\cdot 1.1 + 2.3)$

An original image, a watermarked digital image, a transformation of the original image to media such as printing and a copy made from the media are illustrated schematically:

Orig WM Media Copy

Sharma searches for the orientation vector that provides the strongest signal using a watermark detector. Here we use a Fourier transform as the detector:

Define the expected range of wavevectors for the watermark $c_{min} := 2$ $\quad c_{max} := 12$

$c_1 := c_{min} .. c_{max}$ $\qquad C_{test}(x, y) := (x \geq c_{min}) \wedge (x \leq c_{max})$ $\quad C := \text{matrix}(51, 1, C_{test})$

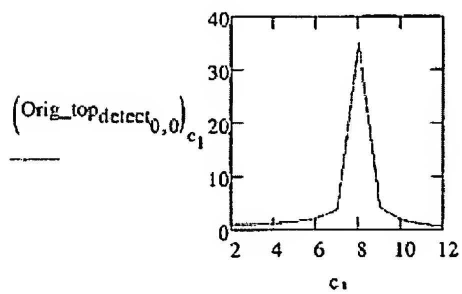
$$\text{Detect}(f) := \left[\overrightarrow{(|\text{cfft}(f)| \cdot C)} \;\; \arg(\text{cfft}(f))\right]$$

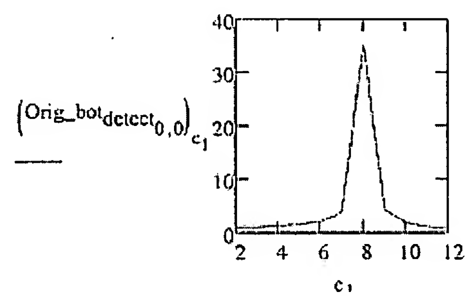
$\text{Orig\_top}_{detect} := \text{Detect}\left[\left(WM^T\right)^{\langle 25 \rangle}\right]$ $\qquad \text{Orig\_bot}_{detect} := \text{Detect}\left[\left(WM^T\right)^{\langle 75 \rangle}\right]$

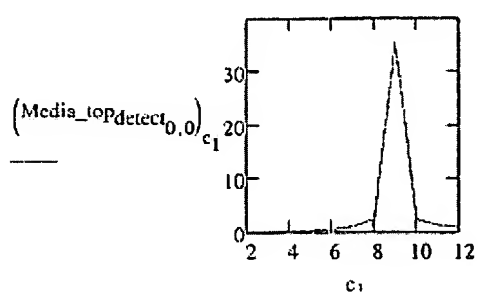
$\text{Media\_top}_{detect} := \text{Detect}\left[\left(\text{Media}^T\right)^{\langle 25 \rangle}\right]$ $\qquad \text{Media\_bot}_{detect} := \text{Detect}\left[\left(\text{Media}^T\right)^{\langle 75 \rangle}\right]$

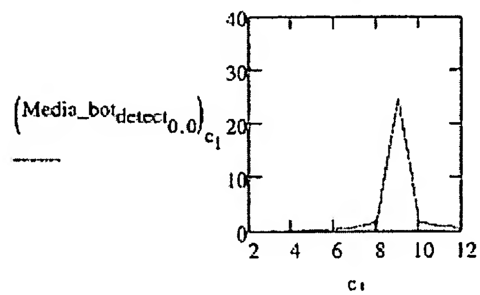
$\text{Copy\_top}_{detect} := \text{Detect}\left[\left(\text{Copy}^T\right)^{\langle 25 \rangle}\right]$ $\qquad \text{Copy\_bot}_{detect} := \text{Detect}\left[\left(\text{Copy}^T\right)^{\langle 75 \rangle}\right]$

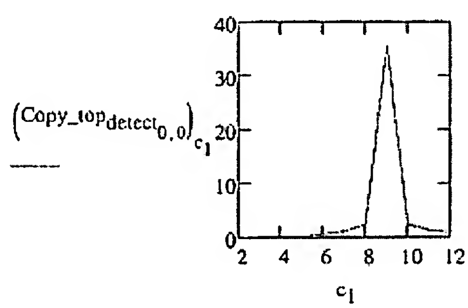
Now Sharma scans the expected range of orientation vectors (in this case phase and wavevector) to find the watermark peak.

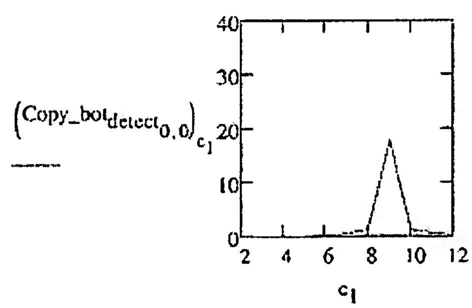


Note that the location of the peak shifted from a wavevector of 8 in the original to a wavevector of 9 in the media signal and in the copy gives the scale of the watermark. The phase of the peak signal gives the location information for the watermark. The phase is the same in the top and bottom of the image.

$\left(\text{Orig\_top}_{\text{detect}_{0,1}}\right)_8 = -0.362$ $\left(\text{Media\_top}_{\text{detect}_{0,1}}\right)_8 = 1.13$

$\left(\text{Orig\_bot}_{\text{detect}_{0,1}}\right)_8 = -0.362$ $\left(\text{Media\_bot}_{\text{detect}_{0,1}}\right)_8 = 1.13$

Notice that in the media signal above, the amplitude of the signal in the bottom brighter region is lower than in the top region. On the other hand, the phase is the same in the top and bottom. Sharma teaches using the phase and peak wavelength to determine the orientation vector. Although the signal strength is lower in the detected Media_bot watermark, this has no influence on the orientation vector. Thus the orientation vector in Sharma is independent of brightness in the data region.

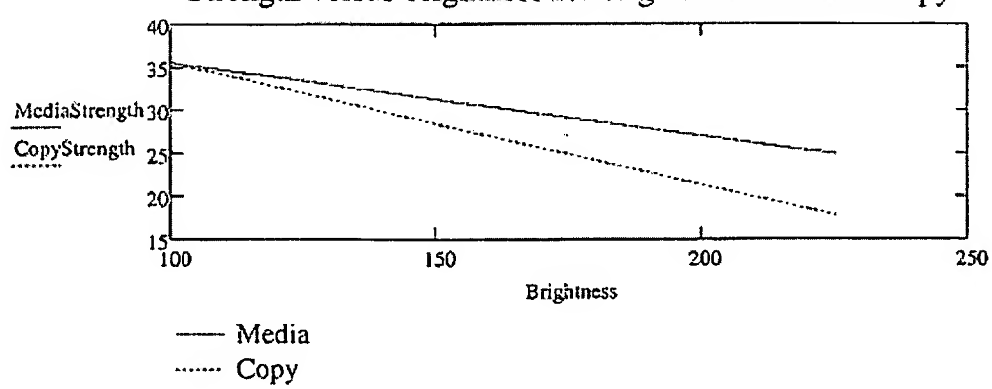
In our case, the strength of the watermark in the copy depends on the brightness in the data block. The following illustrates an image with only two data blocks with a simple sinusoidal watermark.

$\text{Brightness} := \begin{pmatrix} \text{Dark} \\ \text{Light} \end{pmatrix}$ The brightness for the two data regions

$\text{MediaStrength} := \begin{pmatrix} \max\left(\text{Media\_top}_{\text{detect}_{0,0}}\right) \\ \max\left(\text{Media\_bot}_{\text{detect}_{0,0}}\right) \end{pmatrix}$ Expected signal strength of an original watermarked medium

$\text{CopyStrength} := \begin{pmatrix} \max\left(\text{Copy\_top}_{\text{detect}_{0,0}}\right) \\ \max\left(\text{Copy\_bot}_{\text{detect}_{0,0}}\right) \end{pmatrix}$ Signal strength of a copied medium

Strength versus brightness for original media and a copy



Sharma does not disclose or anticipate step e. of Claim 1, as amended, namely, determining a correlation between the recovered watermark data for at least some of the data blocks and average brightness levels for said data blocks.

Sharma does not disclose or anticipate step e. of Claim 10, as amended, namely, determining at least one of (i) a correlation between the recovered watermark data for at least some of the data blocks and average brightness levels for said data blocks, and (ii) a correlation between the recovered watermark data and the wave vectors.

Sharma discloses step (d) of claim 1, namely, applying a watermark detecting operation to the transform domain data for respective ones of the data blocks to generate recovered watermark data. Sharma does not disclose or anticipate step (e) of claims 1 and 10, where there is a correlation between the recovered watermark data and the (average) brightness level of the data blocks.

An advantage of step e. of Claims 1 and 10, over Sharma is that if someone made a copy, the copy process would weaken the watermark more in light areas than in dark areas. The foregoing will make a fraudulent copy easier to detect.

Claims 6-7 and 16-17, have been rejected by the Examiner under 35 USC §103(a) as being unpatentable over Sharma in view of Murakami (US Patent No. 7,065,237).

Murakami discloses the following in col. 9, lines 10-26:

> "The envelope ring pattern generator 902 is a device for generating an envelope ring pattern on the basis of the input additional information and a Fourier amplitude spectrum generated by the Fourier transformer 901. The envelope ring pattern generator 902 is further connected to the envelope ring pattern embedding unit 903.
>
> The envelope ring pattern embedding unit 903 is a device for embedding an envelope ring pattern in a Fourier amplitude spectrum on the basis of the Fourier amplitude spectrum generated by the Fourier transformer 901, the envelope ring pattern generated by the envelope ring pattern generator 902, and the parameter which is input from the parameter input unit 906 and changes depending on the watermark strength or for each embedding. The envelope ring pattern embedding unit 903 is further connected to the inverse Fourier transformer 904."

Muakami discloses embedding an envelope ring pattern in a Fourier amplitude spectrum.

Sharma and Murakami, taken separately or together, do not disclose or anticipate step e. of claims 1 and 10, as amended.

Claims 8 and 18 have been rejected by the Examiner under 35 USC §103(a) as being unpatentable over Sharma in view of Rhoads et al. (US Publication No. 2003/0215112).

Rhoads discloses the following in paragraph [0118]:

> [0118] The uses to which the 128 bits of watermark data can be put in security documents are myriad. Many are detailed in the materials cited above. Examples include postal stamps encoded with their value, or with the zip code of the destination to which they are addressed (or from which they were sent); banknotes encoded with their denomination, and their date and place of issuance; identification documents encoded with authentication information by which a person's identity can be verified, etc., etc.,"

Rhoads discloses a printed image that is a postal indicia.

However, Sharma and Rhoads, taken separately or together, do not disclose or anticipate step e. of Claims 1 and 10, as amended.

In view of the foregoing amendments and remarks, it is respectfully submitted that claims 1, 2, 4-12, and 14-19, of this application are patentable and in a condition for allowance and favorable action thereon is requested.

If the Examiner has any questions, would the Examiner please call the undersigned at the telephone number noted below.

Please charge any additional fees or credit any overpayment to Deposit Account Number 16-1885.

Respectfully submitted,

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